

# Ξ BARYONS ( $S = -2, I = 1/2$ )

$$\Xi^0 = uss, \quad \Xi^- = dss$$

 **$\Xi^0$** 

$$I(J^P) = \frac{1}{2}(\frac{1}{2}+)$$

$P$  is not yet measured; + is the quark model prediction.

Mass  $m = 1314.86 \pm 0.20$  MeV

$m_{\Xi^-} - m_{\Xi^0} = 6.85 \pm 0.21$  MeV

Mean life  $\tau = (2.90 \pm 0.09) \times 10^{-10}$  s

$c\tau = 8.71$  cm

Magnetic moment  $\mu = -1.250 \pm 0.014 \mu_N$

### Decay parameters

$$\Lambda\pi^0 \quad \alpha = -0.406 \pm 0.013$$

$$\quad \phi = (21 \pm 12)^\circ$$

$$\quad \gamma = 0.85^{[a]}$$

$$\quad \Delta = (218^{+12}_{-19})^\circ [a]$$

$$\Lambda\gamma \quad \alpha = -0.70 \pm 0.07$$

$$\Lambda e^+ e^- \quad \alpha = -0.8 \pm 0.2$$

$$\Sigma^0\gamma \quad \alpha = -0.69 \pm 0.06$$

$$\Sigma^+ e^- \bar{\nu}_e \quad g_1(0)/f_1(0) = 1.21 \pm 0.05$$

$$\Sigma^+ e^- \bar{\nu}_e \quad f_2(0)/f_1(0) = 2.0 \pm 1.3$$

NODE=BXXX030

NODE=S023

NODE=S023M;DTYPE=M

NODE=S023D;DTYPE=D

NODE=S023T;DTYPE=T

NODE=S023CTA;DTYPE=C;OUR EVAL

NODE=S023MM;DTYPE=m

CLUMP=D

NODE=S023A;DTYPE=d;CLUMP=D;OUR EVAL

NODE=S023F;DTYPE=d;CLUMP=D

NODE=S023GD;DTYPE=d;CLUMP=D;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

NODE=S023DD;DTYPE=d;CLUMP=D;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

NODE=S023LG;DTYPE=d;CLUMP=D

NODE=S023LEE;DTYPE=d;CLUMP=D

NODE=S023AG;DTYPE=d;CLUMP=D

NODE=S023AH;DTYPE=d;CLUMP=D

NODE=S023AJ;DTYPE=d;CLUMP=D

<b><math>\Xi^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\Lambda\pi^0$	$(99.525 \pm 0.012)\%$	135	
$\Lambda\gamma$	$(1.17 \pm 0.07) \times 10^{-3}$	184	
$\Lambda e^+ e^-$	$(7.6 \pm 0.6) \times 10^{-6}$	184	
$\Sigma^0\gamma$	$(3.33 \pm 0.10) \times 10^{-3}$	117	
$\Sigma^+ e^- \bar{\nu}_e$	$(2.53 \pm 0.08) \times 10^{-4}$	120	
$\Sigma^+ \mu^- \bar{\nu}_\mu$	$(4.6 \pm 1.8) \times 10^{-6}$	64	

NODE=S023225;DESIG=1

DESIG=9

DESIG=12

DESIG=10

DESIG=4

DESIG=6

NODE=S023;CLUMP=A

DESIG=5

DESIG=7

DESIG=2

DESIG=3

DESIG=8

 **$\Xi^-$** 

$$I(J^P) = \frac{1}{2}(\frac{1}{2}+)$$

$P$  is not yet measured; + is the quark model prediction.

Mass  $m = 1321.71 \pm 0.07$  MeV

$(m_{\Xi^-} - m_{\Xi^+}) / m_{\Xi^-} = (-3 \pm 9) \times 10^{-5}$

Mean life  $\tau = (1.639 \pm 0.015) \times 10^{-10}$  s

$c\tau = 4.91$  cm

$(\tau_{\Xi^-} - \tau_{\Xi^+}) / \tau_{\Xi^-} = -0.01 \pm 0.07$

Magnetic moment  $\mu = -0.6507 \pm 0.0025 \mu_N$

$(\mu_{\Xi^-} + \mu_{\Xi^+}) / |\mu_{\Xi^-}| = +0.01 \pm 0.05$

NODE=S022M;DTYPE=M

NODE=S022DMM;DTYPE=D

NODE=S022T;DTYPE=T

NODE=S022CTA;DTYPE=C;OUR EVAL

NODE=S022DT;DTYPE=i

NODE=S022MM;DTYPE=m

NODE=S022MMD;DTYPE=i;OUR EVAL; $\rightarrow$  UNCHECKED  $\leftarrow$

NODE=S022

**Decay parameters**

$$\begin{aligned}
 \Lambda\pi^- & \quad \alpha = -0.458 \pm 0.012 \quad (S = 1.8) \\
 [\alpha(\Xi^-)\alpha_-(\Lambda) - \alpha(\Xi^+)\alpha_+(\bar{\Lambda})] / [\text{sum}] & = (0 \pm 7) \times 10^{-4} \\
 " & \quad \phi = (-2.1 \pm 0.8)^\circ \\
 " & \quad \gamma = 0.89^{[a]} \\
 " & \quad \Delta = (175.9 \pm 1.5)^\circ [a] \\
 \Lambda e^- \bar{\nu}_e & \quad g_A/g_V = -0.25 \pm 0.05^{[b]}
 \end{aligned}$$

CLUMP=D

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NODE=S022A;DTYPE=d;CLUMP=D;OUR EVAL;→ UNCHECKED ←
NODE=S022ACP;DTYPE=d;CLUMP=D
NODE=S022F;DTYPE=d;CLUMP=D
NODE=S022GD;DTYPE=d;CLUMP=D;OUR EVAL;→ UNCHECKED ←
NODE=S022DD;DTYPE=d;CLUMP=D;OUR EVAL;→ UNCHECKED ←
NODE=S022AV;DTYPE=d;CLUMP=D

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$\Xi^-$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\Lambda\pi^-$	(99.887 $\pm$ 0.035) %		140
$\Sigma^-\gamma$	( 1.27 $\pm$ 0.23 ) $\times$ 10 <sup>-4</sup>		118
$\Lambda e^- \bar{\nu}_e$	( 5.63 $\pm$ 0.31 ) $\times$ 10 <sup>-4</sup>		190
$\Lambda\mu^- \bar{\nu}_\mu$	( 3.5 $\pm$ 3.5 ) $\times$ 10 <sup>-4</sup>		163
$\Sigma^0 e^- \bar{\nu}_e$	( 8.7 $\pm$ 1.7 ) $\times$ 10 <sup>-5</sup>		123
$\Sigma^0 \mu^- \bar{\nu}_\mu$	< 8 $\times$ 10 <sup>-4</sup>	90%	70
$\Xi^0 e^- \bar{\nu}_e$	< 2.3 $\times$ 10 <sup>-3</sup>	90%	7

 **$\Delta S = 2$  forbidden (S2) modes**

$n\pi^-$	S2	< 1.9 $\times$ 10 <sup>-5</sup>	90%	304
$n e^- \bar{\nu}_e$	S2	< 3.2 $\times$ 10 <sup>-3</sup>	90%	327
$n\mu^- \bar{\nu}_\mu$	S2	< 1.5 %	90%	314
$p\pi^-\pi^-$	S2	< 4 $\times$ 10 <sup>-4</sup>	90%	223
$p\pi^-e^-\bar{\nu}_e$	S2	< 4 $\times$ 10 <sup>-4</sup>	90%	305
$p\pi^-\mu^-\bar{\nu}_\mu$	S2	< 4 $\times$ 10 <sup>-4</sup>	90%	251
$p\mu^-\mu^-$	L	< 4 $\times$ 10 <sup>-8</sup>	90%	272

 **$\Xi(1530)$  3/2<sup>+</sup>**

$$I(J^P) = \frac{1}{2}(\frac{3}{2}+)$$

 $\Xi(1530)^0$  mass  $m = 1531.80 \pm 0.32$  MeV ( $S = 1.3$ ) $\Xi(1530)^-$  mass  $m = 1535.0 \pm 0.6$  MeV $\Xi(1530)^0$  full width  $\Gamma = 9.1 \pm 0.5$  MeV $\Xi(1530)^-$  full width  $\Gamma = 9.9^{+1.7}_{-1.9}$  MeV

NODE=B049

NODE=B049M0;DTYPE=M

NODE=B049M-;DTYPE=M

NODE=B049W0;DTYPE=G

NODE=B049W-;DTYPE=G

$\Xi(1530)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level	$p$ (MeV/c)
$\Xi\pi$	100 %		158
$\Xi\gamma$	< 4 %	90%	202

 **$\Xi(1690)$** 

$$I(J^P) = \frac{1}{2}(?^?)$$

Mass  $m = 1690 \pm 10$  MeV [c]Full width  $\Gamma < 30$  MeV

NODE=B049225;DESIG=1;OUR EST

DESIG=2

NODE=B105

NODE=B105M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=B105W;DTYPE=G;OUR EST;

→ UNCHECKED ←

$\Xi(1690)$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda\bar{K}$	seen	240
$\Sigma\bar{K}$	seen	70
$\Xi\pi$	seen	311
$\Xi^-\pi^+\pi^-$	possibly seen	213

NODE=B105215;DESIG=2

DESIG=1;OUR EST

DESIG=3;OUR EST

DESIG=6

 **$\Xi(1820)$  3/2<sup>-</sup>**

$$I(J^P) = \frac{1}{2}(\frac{3}{2}-)$$

Mass  $m = 1823 \pm 5$  MeV [c]Full width  $\Gamma = 24^{+15}_{-10}$  MeV [c]

NODE=B050

NODE=B050M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=B050W;DTYPE=G;OUR EST;

→ UNCHECKED ←

<b><math>\Xi(1820)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda\bar{K}$	large	402
$\Sigma\bar{K}$	small	324
$\Xi\pi$	small	421
$\Xi(1530)\pi$	small	237

NODE=B050215;DESIG=1;OUR EST  
 DESIG=3;OUR EST  
 DESIG=2;OUR EST  
 DESIG=4;OUR EST

 **$\Xi(1950)$** 

$$I(J^P) = \frac{1}{2}(\frac{?}{?})$$

Mass  $m = 1950 \pm 15$  MeV [c]  
 Full width  $\Gamma = 60 \pm 20$  MeV [c]

<b><math>\Xi(1950)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda\bar{K}$	seen	522
$\Sigma\bar{K}$	possibly seen	460
$\Xi\pi$	seen	519

NODE=B052

NODE=B052M;DTYPE=M;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=B052W;DTYPE=G;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$

 **$\Xi(2030)$** 

$$I(J^P) = \frac{1}{2}(\frac{5}{2}?)$$

Mass  $m = 2025 \pm 5$  MeV [c]  
 Full width  $\Gamma = 20^{+15}_{-5}$  MeV [c]

<b><math>\Xi(2030)</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$\Lambda\bar{K}$	$\sim 20\%$	585
$\Sigma\bar{K}$	$\sim 80\%$	529
$\Xi\pi$	small	574
$\Xi(1530)\pi$	small	416
$\Lambda\bar{K}\pi$	small	499
$\Sigma\bar{K}\pi$	small	428

NODE=B068

NODE=B068M;DTYPE=M;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$   
 NODE=B068W;DTYPE=G;OUR EST;  
 $\rightarrow$  UNCHECKED  $\leftarrow$

## NOTES

[a] The decay parameters  $\gamma$  and  $\Delta$  are calculated from  $\alpha$  and  $\phi$  using

$$\gamma = \sqrt{1-\alpha^2} \cos\phi, \quad \tan\Delta = -\frac{1}{\alpha} \sqrt{1-\alpha^2} \sin\phi.$$

See the "Note on Baryon Decay Parameters" in the neutron Particle Listings.

[b] The parameters  $g_A$ ,  $g_V$ , and  $g_{WM}$  for semileptonic modes are defined by  $\bar{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i}) \sigma_{\lambda\nu} q^\nu]B_i$ , and  $\phi_{AV}$  is defined by  $g_A/g_V = |g_A/g_V| e^{i\phi_{AV}}$ . See the "Note on Baryon Decay Parameters" in the neutron Particle Listings.

[c] The error given here is only an educated guess. It is larger than the error on the weighted average of the published values.

LINKAGE=SBE

LINKAGE=SBD

LINKAGE=BH